Trans-Lake Washington Project EIS Methodology Report – 6/10/02

Noise

Under the Trans-Lake Washington Project, several potential noise sources could cause impacts at sensitive receiver locations throughout the SR 520 corridor. Impact criteria and analysis methods for long-term operational and short-term construction impacts are addressed in the appropriate sections below.

Guiding Plans and Policies

- U.S. Department of Transportation (USDOT), 23 CFR Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise.
- Washington State Department of Transportation (WSDOT), *Traffic Noise Analysis and Abatement, Policy and Procedures Manual,* November 1997.
- USDOT, *FHWA Highway Construction Noise: Measurement, Prediction and Mitigation,* 1997.
- USDOT, FHWA Highway Traffic Noise Prediction Model TNM Version 1.1, 1998, or newer if available.
- Washington State Administrative Code (WAC), Chapter 173-60, Maximum Environmental Noise Levels.
- WSDOT Environmental Procedures Manual, Section 446, July 2001.
- Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment Manual.*

In addition to the plans and policies given above, a detailed review of other noise regulations and ordinances will be performed to determine applicability to the Trans-Lake Washington Project.

Data Needs and Sources

Traffic-noise levels are calculated using FHWA-approved noise models. The noise model that will be used for the Trans-Lake Washington Project is TNM Version 1.1, or newer if available (USDOT 1998).

Input to the model includes traffic volume and speed data generated by project traffic operations team. Noise emission levels used in the models are nationwide averages for automobiles, trucks. In addition to the traffic information, noise-reducing effects of front-line structures located directly adjacent to the project roadway, roadway depressions, and topography are included in the calculations where appropriate. Using the above

information, the model predicts the hourly L_{eq} at selected receiver locations along the project corridor.

Data sources for the noise analysis include:

- SR 520 Traffic: Existing traffic volumes and future traffic volumes for each alternative for SR 520 and all connector ramps, to include percentages of passenger vehicles, trucks, and buses.
- Arterial Roadway Traffic: Traffic volumes for all major arterial roadways adjacent to the SR 520 corridor.
- Hourly Traffic Breakdown: Traffic volumes on an hourly basis between the hours of 5 AM and 10 AM and between the hours of 2:30 PM and 7:30 PM during normal weekdays. The data will be reviewed and analyzed, and the peak-noise hour, which is the loudest hour of the day, will be used in the analysis.
- Travel Speeds: Because of the complexity of the corridor and potential speed variations under each of the alternatives, hourly average travel speeds will also be required for each of the hourly traffic data. The speeds will be required for SR 520 and all arterial roadways adjacent to the project corridor.
- Project Design Drawings: Detailed design drawings to model the roadways in the corridor, including SR 520 and all connector ramps and associated arterial streets within 500 feet of the project corridor. The design drawings will include proposed noise walls (based on preliminary analysis) and design options such as lids and expanded overpasses.
- Topographical Information: Detailed topographical information for input to the noise model; this will include information such as berms, hillsides, depressed roads and lidded sections of roads, existing structures, and any other topographical information that may affect the propagation of noise in the corridor. In addition, any ground features that may be altered during construction will also be noted and used in the noise analysis.
- Ground Cover: Ground cover between the noise source and receivers in the area for use in the noise model, obtained through a combination of aerial photos and site visits. Ground cover model inputs include pavement, water, grass, and foliage, such as evergreen trees, that will affect how the noise propagates between the noise source and the receivers. In addition, any ground cover that may be altered during construction will also be noted and used in the noise analysis.
- Receiver Information: The locations of all noise sensitive receivers within 500 feet of the project corridor. The drawings will include the northing, easting, and elevations for each receiver location.
- Land Use Planning: Detailed information on the existing land use within 500 feet of the project corridor. This information could be in GIS form.

Proposed Coordination with Agencies

Local agencies will be contacted as needed for information on project-area details. Those agencies include the cities of Seattle, Medina, Hunts Point, Yarrow Point, Clyde Hill, Kirkland, Bellevue, and Redmond.

Proposed Coordination with Team, WSDOT, and Sound Transit

The noise analyst will coordinate with Mia Waters and John Maas as the primary WSDOT contacts. Coordination will be required with the team leads of the following studies:

- Project Design Drawings – details on the required information are given under *Data Needs and Sources*.
- Relocations – need to know if and where any public facilities, residents or commercial uses would be displaced.
- Land Use – details on project area land use, including noise sensitive receivers such as residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, auditoriums and office space. Also need to know if and where any substantial changes in land use would be expected.
- Transportation – details on the traffic data needs are described under *Data Needs and Sources*.
- Recreation and Section 4(f) / Section 6(f) Resources – will coordinate analysis of any potential noise impacts on parks, historic properties or other Section 4(f) resources with Bob Swope and Jim Bard, CH2M HILL.

Study Area

As defined in the WSDOT Policy and Procedures Manual, and in 23 CFR Part 722, the project study will include all lands within 500 feet of the project. A detailed reconnaissance of the project area will be performed to identify all noise sensitive properties. The study area will include Eastlake, Portage Bay, Roanoke, North Capitol Hill, Montlake, University, Laurelhurst, and Madison Park in Seattle; Medina; Hunts Point; Yarrow Point; Clyde Hill; Lakeview in Kirkland; Northtown, Bridle Trails, and Bel-Red / Northup in Bellevue; and Overlake, Grass Lawn, Downtown Redmond, Northeast Redmond, and Southeast Redmond in Redmond. Physical features, such as terrain and ground cover will be noted during the reconnaissance trips, along with any potential features that could be altered during construction.

It is possible that some roadways farther than 500 feet from the SR 520 Corridor may experience increases in traffic volumes and noise under the build alternatives. Under WSDOT policy, any roadway that is modified as part of the project will be subject to the same level of noise analysis as SR 520. For those roadways where no modifications are projected, no noise mitigation analysis will be performed.

Affected Environment Methodology

The affected environment will be established through GIS data, onsite reconnaissance trips, field noise measurements, traffic counts, speed measurements, and existing reports.

Land Use

Land use types established by the FHWA for traffic-noise analysis include the five categories shown in Table 1. The land use will be established through GIS data, onsite reconnaissance trips, and city comprehensive plans.

Table 1. FHWA Land Use Categories

Type	Land Use Description
A	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, (exterior) motels, hotels, schools, churches, libraries, and hospitals
C	Developed lands, properties, or activities not included in the above categories
D	Undeveloped land
E	Interiors of residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

FHWA and WSDOT use outdoor locations to determine noise impacts, except under special circumstances. Noise measurements for land use categories Type A through Type D are all taken 5 feet off the ground at a distance at least 15 feet from the nearest structure on the property. Second floor analysis, for those locations where second story outdoor residential uses are identified, will be analyzed at 5 and 15 feet above ground level at receiver locations. Land use category Type E is only used for noise-sensitive land use where there is no outdoor use at the location or for those locations where the interior noise levels are the main concern, such as a library.

Noise Monitoring Locations

Monitoring will be performed at up to 90 locations in the SR 520 corridor, including 20 long-term (24-hour) locations and 70 short-term (15 to 30 minutes) locations. The number of recommended noise monitoring locations was estimated using aerial mapping of the project corridor, with special attention given to residential areas and the location of SR 520 and other major connector and arterial roads. The final selection of noise monitoring locations was made through a joint effort between the Trans-Lake Project Team, WSDOT, and Sound Transit. A summary of the currently proposed monitoring program is given below.

- **Segment 1: Seattle; I-5 to Lake Washington Floating Bridge:** Approximately 24 locations are proposed for the SR 520 corridor between I-5 and SR 520. Up to 6 of the 20 locations will be monitored for 24-hour periods, with the other 18 locations used as short-term (30-minute) onsite attended monitoring locations.
- **Segment 2: Lake Washington Floating Bridge:** Four to six locations are proposed for noise sensitive areas affected by the floating bridge section of the project. Short-term noise monitoring is proposed at four noise sensitive locations along Lake Washington

south of the floating bridge. Two additional short-term locations are proposed north of the floating bridge in the Laurelhurst area.

- **Segment 3: East Bank of Lake Washington to I-405:** Thirty-six locations are proposed for the area between the eastern high-rise and I-405. Eight of the 36 locations would be long-term unattended locations, with the other 28 proposed as short-term locations.

- **Segment 4: I-405 to Redmond:** Twenty-four locations are proposed for the SR 520 corridor between I-405 and the end of the project corridor in Redmond. Six of the 24 locations would be 24-hour sites, with the other 18 used for short-term unattended monitoring sites.

Noise Monitoring Methods

Equipment used for project area noise monitoring are sound level meters that meet or exceed the requirements for an ANSI Type 1 noise measurement system. All systems are calibrated prior to and after the measurement period using a certified sound level calibrator. All system calibration is traceable to the National Institute of Standards and Testing (NIST) on an annual basis.

Traffic Data

Traffic counts will be performed, whenever possible, during the onsite noise monitoring. Because of the high levels of traffic and site restrictions, traffic counts may not be possible for all monitoring sites. Whenever actual counts are available, they will be used to perform validation of the existing conditions noise model.

Speed Data

Existing speed data will be obtained using an Astroproducts Phantom hand-held Doppler Radar Gun. The system is equipped with a 60 mile per hour (mph) calibration generator and is accurate to +/- 2 mph . Measurements are taken in conjunction with noise level measurements and the actual speeds are used to calibrate the noise model.

Existing Conditions Noise Modeling

Information listed under *Data Needs and Sources*, measured noise levels, speeds, and traffic counts will be used to build and construct a traffic noise model. All receivers used during the onsite noise measurements will also be used as noise modeling locations. TNM is the traffic noise model to be used on the Trans-Lake Washington Project. The model will be validated to match the measured levels within +/- 2 dBA, whenever possible. If accurate calibration is not possible, documentation will be provided that describes the reason for the lack of calibration. Once the model has been calibrated, existing peak hour traffic volumes generated by the project traffic engineers will be used with speed limits to calculate existing peak hour noise levels.

Data Reduction and Summary Analysis

A technical report summarizing the noise-monitoring program will be compiled. The contents will include a detailed description of the monitoring methods, land use in the area, summaries of the measured noise levels, and an appendix with complete tabulated data from the monitoring program. The report will also include vicinity maps showing all noise

monitoring locations at an appropriate scale. Comparative tables and graphs of the monitoring data will be prepared to aid in the understanding of monitored noise levels. Traffic counts and speed measurements will also be included where applicable.

Environmental Consequences Analysis Methodology

Direct Impacts

Future year traffic noise levels for the No Action Alternative and the three build alternatives will be modeled using the Traffic Noise Model (TNM). Peak hour noise in the year 2030 for the No Action Alternative and for each of the three build alternatives will be modeled at selected noise sensitive receptors based on forecast traffic volumes. Information used in the noise model is described under *Data Needs and Sources*. The noise modeling will predict the noise levels at each of the receptors, and will assess the number of properties within 500 feet of the project that are impacted or will be impacted and the amount of noise reduction to each outdoor area that can be achieved with the proposed mitigation.

Noise modeling for land use categories Type A through Type D (see Table 1) will assume a location of 5 feet off the ground at a distance at least 15 feet from the nearest structure on the property. Second floor analysis, for those locations where second story outdoor residential uses are identified, will be analyzed using 15 feet above ground-level receiver locations.

Noise impacts will be determined using the FHWA / WSDOT traffic noise impact criteria as defined in the WSDOT Policy and Procedures Manual. Traffic noise impact criteria, against which the project traffic-noise levels would be evaluated, are provided in 23 CFR 772. The criteria applicable for residences, churches, schools, recreational uses, and similar areas are an exterior hourly equivalent sound level (L_{eq}) that "approaches or exceeds" 67 dBA. The criteria applicable for other developed lands such as commercial and industrial uses are an exterior L_{eq} that approaches or exceeds 72 dBA. FHWA also considers a traffic-noise impact to occur if future noise levels are projected to result in a "substantial increase" over existing noise levels.

WSDOT clarifies the meaning of "approaches or exceeds" by considering a traffic-noise impact to occur when predicted project-related noise levels approach the criteria level within 1 dBA, or when project-related noise levels substantially exceed existing levels. Therefore, residential impacts occur at 66 dBA and commercial impacts at 71 dBA. These WSDOT criteria, approved for use by FHWA for highway projects in the state of Washington, will be used for the Trans-Lake Washington Project. A 10 dBA increase is considered substantial if the resulting noise level is greater than 50 dBA. There are no criteria for underdeveloped lands or construction noise. Severe noise impacts are defined as traffic noise levels of 75 dBA L_{eq} and higher for outdoor activity areas and 60 dBA L_{eq} and higher for indoor areas or a predicted design year increase of at least 15 dBA over existing noise levels. Measurements must be in accordance with FHWA "Measurement of Highway-Related Noise."

All noise impacts identified under the WSDOT criteria will be cataloged, and comparative tables will be constructed to provide an easy method of performing a noise level comparison among the different alternatives. The tables will include the existing noise levels, along with the noise levels for each build alternative and columns providing the incremental change in noise between each alternative at all modeled receiver locations. Detailed vicinity maps

showing all noise modeling locations, with noise impacts clearly identified, will be produced at an appropriate scale for the entire project corridor for each alternative. An overall comparison of the severity of noise impacts among the different alternatives will be included.

Supplemental Noise Level Analysis

Seattle City Councilmember Richard Conlin, on behalf of Seattle neighborhoods, requested that neighborhood noise impacts be measured using 65 L_{dn} at 25 feet above the surface as the noise standard. This section is in response to that request.

In addition to the detailed noise level and impact analysis performed using FHWA / WSDOT criteria, supplemental noise level calculations will be performed throughout the project corridor to assist in the characterization of each alternative's effect on the acoustic environment. The 24-hour average daily L_{dn} noise levels will be included in the Trans-Lake Noise Technical Report for information and planning purposes. The L_{dn} is a 24-hour average noise level with 10 dBA penalty added to the nighttime noise levels (10:00 PM to 7:00 AM) to account for increased sensitivity to nighttime noise. This noise descriptor is often used for planning land uses. The supplemental noise analysis will not be used to determine mitigation for the project, but will be used to identify opportunities for enhancements in the SR 520 Corridor.

L_{dn} noise level calculations will be performed for all modeled receiver locations in the project corridor, both with and without the project noise abatement measures and under the No Action Alternative and the build alternatives. The L_{dn} calculations will include any second floor receivers used in the impact analysis. Comparative L_{dn} tables will include the existing and build noise levels for each alternative, along with columns providing the incremental change in noise between each alternative at all modeled receiver locations with and without the noise abatement measures.

Finally, noise level calculations may also be performed for select noise sensitive receiver locations that are located greater than 500 feet from the project. Calculations for these supplemental receivers will include the peak-hour traffic noise level and the 24-hour L_{dn}. This information will also be presented in the Noise Technical Report.

Construction Impacts

Construction noise and vibration related to the Trans-Lake Washington Project will be analyzed using information and measured noise levels from WSDOT, FHWA, and similar projects. Noise and vibration levels will be projected using the methods described in the FHWA Highway Construction Manual in addition to other relevant sources.

General noise levels for several different construction scenarios will be projected at selected noise sensitive receivers located in the study area. The projected noise levels will be compared to the Washington State Administrative Code noise regulations to determine potential noise impacts. Where impacts are identified, mitigation measures that could be implemented as part of the construction project will be suggested.

In addition, an analysis of potential nighttime construction activities will also be performed. Even though most of the work could be completed during daytime hours, when a noise variance would not be required, the high level of traffic and need to complete the project in

a timely manner, may require some nighttime construction activities. The purpose of the analysis will be to determine what, if any, construction activities could take place outside the normally permitted construction hours of 7:00 AM to 10:00 PM without noise impacts.

A technical section of the noise report would include details on the methods of analysis, equipment listing, construction staging scenarios, and potential noise impacts.

Mitigation Measure Methodology

In accordance with FHWA and WSDOT requirements, noise abatement measures will be considered at locations along the alignments where traffic noise impacts are predicted. Mitigation measures considered must include walls or berms, as well as the five other FHWA methods specifically mentioned in 23 CFR 772. The mitigation analysis will provide location, length, height, profile, estimated cost, and number of benefiting noise sensitive properties for each proposed barrier or other proposed mitigation measure. The analysis will include a complete discussion of impacted areas that do not meet the WSDOT criteria for abatement and specifically note reasons for not including mitigation.

Michael Minor
Michael Minor & Associates
503-220-0495
mminor@drnoise.com